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| | |
|---|------------------------------------|
| Then to $U^* = 55^\circ 26' 57''$ | Log tang ^t . 10 1620405 |
| Add half the sum of the log ^s . of the aphelion and perihelion dist. | 6.2800876 |
| | 16.4421281 |
| Deduct the log. of the mean dist. | 6.2805800 |
| The remainder is the log. tang ^t . of $55^\circ 25' 7''$ | 10.1615481 |

The co-equate or true anomaly $55^\circ 15' 7''$ is the measure of the angle ACr , and when deducted from the mean anomaly will leave the equation of the centre: as for example, $55^\circ 25' 7''$ taken from 60° the mean anomaly used in the foregoing explanation the remainder $4^\circ 34' 53''$ will be the equation of the centre answering to it.—The equation of the centre must be negatively applied while the planet is moving from the aphelion, to the perihelion, and *vice versa*.

I am, Sir, with much esteem,

Your real Friend,

ANDREW ELLICOTT.

To Mr. Robert Patterson.

Nº. IX.

Method of raising the common Logarithm of any Number immediately, by DAVID RITTENHOUSE, President of the Society.

Read Aug. 12, 1795. **T**HE logarithm of any number is the index of that power of 10 which is equal to the given number. This index will always be fractional, unless the number be divisible by 10 without any remainder.

If the number be greater than 10, divide it by the highest power of 10 that will leave the quotient not less than 1. The index of that power is the first figure, or index of the logarithm. Divide 10 by the quotient so found raised to the highest power that will leave the new quotient not less than unity. Divide

* *Note.* When U exceeds 90° take its supplement and in that case deduct the result of the calculation from two right angles, and the remainder will be the true anomaly.

the last divisor by the last quotient raised to its proper power, and proceed in this manner until a sufficient number of divisions are made, which will be when the quotient approaches nearly to unity. Make a compound fraction, taking the successive indexes of the powers you divide by for denominators and unity for numerators. Reduce this compound fraction to a simple one, and that by division to a decimal fraction, which together with the index first found (if any) will be the logarithm required.

Example of the Calculation.

Required the Logarithm of 99.

Divided by $\frac{99}{10^1} = 9.9$. Here 1 is the index.

Divided by $\frac{10}{9.9^1} = 1.010101 = a$.

| | | | | | |
|--------------------------------------|---------------------|----------------------|----------------|---|------------------|
| a, raised to its highest power, 228. | $a a = 1.020304$ | First quotient, | 9.9 | } | $= b = 1.001059$ |
| | 20406 | Divided by a^{228} | 9.889521 | | |
| | 306 | | <u>.010479</u> | | |
| | 4 | | 9889 | | |
| | <hr/> | | <hr/> | | |
| | $a^4 = 1.041020$ | | 590 | | |
| | 41641 | | 494 | | |
| | 1041 | | <hr/> | | |
| | 21 | | 96 | | |
| | <hr/> | | 89 | | |
| | $a^8 = 1.083723$ | | <hr/> | | |
| | 86698 | | 7 | | |
| | 3251 | | | | |
| | 759 | | | | |
| | 22 | | | | |
| | 3 | | | | |
| | <hr/> | | | | |
| | $a^{16} = 1.174456$ | | | | |
| | 117446 | | | | |
| | 82212 | | | | |
| | 4698 | | | | |
| | 470 | | | | |
| | 59 | | | | |
| | 7 | | | | |
| | <hr/> | | | | |
| | $a^{32} = 1.379348$ | | | | |

$$\begin{array}{r}
 \text{First quotient, } 9.9 \\
 \text{Divided by } a^{228} = 9.889521 \quad \left. \vphantom{\begin{array}{l} \text{First quotient, } 9.9 \\ \text{Divided by } a^{228} = 9.889521 \end{array}} \right\} = b = 1.001059 \\
 \begin{array}{r}
 .010479 \\
 9889 \\
 590 \\
 494 \\
 \hline
 96 \\
 89 \\
 \hline
 7
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 1001 \\
 59 \\
 \hline
 b^2 = 1.002119 \\
 2004 \\
 119 \\
 \hline
 b^4 = 1.004242 \\
 4017 \\
 201 \\
 42 \\
 \hline
 b^8 = 1.008502 \\
 \times \text{ by } b \\
 1009 \\
 59 \\
 \hline
 b^{16} = 1.009570 \\
 b^{32} = 1.009570 \quad \left. \vphantom{\begin{array}{l} b^{16} = 1.009570 \\ b^{32} = 1.009570 \end{array}} \right\} = c = 1.000526 \\
 \begin{array}{r}
 .000531 \\
 505 \\
 \hline
 26
 \end{array}
 \end{array}$$

Calculation Continued.

$$\begin{array}{r}
 a^{12} = 1.379348 \\
 \quad 413804 \\
 \quad \quad 96554 \\
 \quad \quad \quad 12414 \\
 \quad \quad \quad \quad 415 \\
 \quad \quad \quad \quad \quad 55 \\
 \quad \quad \quad \quad \quad \quad 11 \\
 \hline
 a^{64} = 1.902600 \\
 \quad 1.712340 \\
 \quad \quad 3805 \\
 \quad \quad \quad 1141 \\
 \hline
 a^{128} = 3.619886 \\
 \times \text{ by } a^{64} \quad 3.257897 \\
 \quad \quad \quad 7240 \\
 \quad \quad \quad \quad 2172 \\
 \hline
 a^{192} = 6.887195 \\
 \times \text{ by } a^{12} \quad 2.066158 \\
 \quad \quad \quad 482104 \\
 \quad \quad \quad \quad 61985 \\
 \quad \quad \quad \quad \quad 2066 \\
 \quad \quad \quad \quad \quad \quad 275 \\
 \quad \quad \quad \quad \quad \quad \quad 55 \\
 \hline
 a^{224} = 9.499838 \\
 \times \text{ by } a^4 \quad 379993 \\
 \quad \quad \quad 9500 \\
 \quad \quad \quad \quad 190 \\
 \hline
 a^{228} = 9.889521
 \end{array}$$

$$\text{Divided by } \left. \begin{array}{l} b = 1.001059 \\ c^2 = 1.001052 \end{array} \right\} = d = 1.000007$$

The quotient d , is now so small that it is not necessary to proceed further in this way, for the decimals of c , divided by the decimals of d will give the power required, viz. 75.

Making a compound fraction, as before directed, with the several powers of the divisors in the order they stand we have.

$$\frac{1}{\frac{1}{\frac{1}{228} \frac{1}{9} \frac{1}{2} \frac{1}{75}}}$$

$$\text{Which reduced } 75$$

$$\text{Gives the } 151 = 75 \times 2 + 1$$

$$1434 = 151 \times 9 + 75$$

$$\text{Simple fraction } \frac{327103}{328537} = 1434 \times 228 + 151$$

$$\text{Denominator } 328537 \left. \begin{array}{l} \text{Numerator } 327103,0 \\ 2956833 \end{array} \right\}$$

.995635194.8. The decimal part of the log. of 99. true to the 9th place, and 3 too much in the 10th.

$$\begin{array}{r}
 327103,0 \\
 \underline{2956833} \\
 3141970 \\
 \underline{2956833} \\
 1851370 \\
 \underline{1642685} \\
 2086850 \\
 \underline{1971222} \\
 1156280 \\
 \underline{985611} \\
 170669 \\
 \underline{164268} \\
 6400 \\
 \underline{3285} \\
 3115 \\
 \underline{2957} \\
 158 \\
 \underline{131} \\
 27
 \end{array}$$